2C-R4WM SPECTROSCOPY OF JET COOLED NO_3

MASARU FUKUSHIMA, TAKASHI ISHIWATA, *Information Sciences, Hiroshima City University, Hiroshima, Japan*; EIZI HIROTA, *The Central Office, The Graduate University for Advanced Studies, Hayama, Kanagawa, Japan*.

We have generated NO_3 from pyrolysis of N_2O_5 following supersonic free jet expansion, and carried out two color resonant four wave mixing (2C-R4WM) spectroscopy of the $\tilde{B}\ ^2E'$ – $\tilde{X}\ ^2A_2'$ electronic transition. One laser was fixed to pump NO_3 to a ro-vibronic level of the $\tilde{B}$ state, and the other laser (probe) was scanned across two levels of the $\tilde{X}\ ^2A_2'$ state lying at 1051 and 1492 cm^{-1}, the ν_1 (a_1') and ν_3 (e') fundamentals, respectively. The 2C-R4WM spectra have unexpected back-ground signal of NO_3 (stray signal due to experimental set-up is also detected) similar to laser induced fluorescence (LIF) excitation spectrum of the 0-0 band, although the back-ground signal was not expected in considering the 2C-R4WM scheme. Despite the back-ground interference, we have observed two peaks at 1051.61 and 1055.29 cm^{-1} in the ν_1 region of the spectrum, and the frequencies agree with the two bands, 1051.2 and 1055.3 cm^{-1}, of our relatively higher resolution dispersed fluorescence spectrum, the former of which has been assigned to the ν_1 fundamental. Band width of both peaks, $\sim$ 0.2 cm^{-1}, is broader than twice the experimental spectral-resolution, 0.04 cm^{-1} (because this experiment is double resonance spectroscopy), and the 1051.61 cm^{-1} peak is attributed to a Q branch band head (a line-like Q branch) of the ν_1 fundamental. The other branches are suspected to be hidden in noise of the back-ground signal. The 1055.29 cm^{-1} peak is also attributed to a Q band head. The $\tilde{B}\ ^2E'_{\frac{1}{2}}$ ($J' = \frac{3}{2}$, $K' = 1$) – $\tilde{X}\ ^2A_2'$ ($N'' = 1$, $K'' = 0$) ro-vibronic transition was used as the pump transition. The dump (probe) transition to both a_1' and e' vibronic levels are then allowed as perpendicular transition. Accordingly, it cannot be determined from present results whether the 1055.29 cm^{-1} band is attributed to a_1' or e' (ν_3), unfortunately. The 2C-R4WM spectrum of the 1492 cm^{-1} band region shows one Q head at 1499.79 cm^{-1}, which is consistent with our dispersed fluorescence spectrum. By considering with the ν_3 + ν_4 - ν_4 hot band[a], the present results suggest that both 1055.29 and 1499.79 cm^{-1} levels are a_1' level.

[a] K. Kawaguchi *et al.*, *J. Phys. Chem. A* 117, 13732 (2013) and E. Hirota, *J. Mol. Spectrosco.* 310, 99 (2015).